Professional and Technical Occupations

Air Transportation-Related Occupations

Aircraft Pilots and Flight Engineers

(O*NET 97702B, 97702C, 97702D, 97702E, 97702H, and 97702J)

Significant Points

- Competition is expected for jobs because aircraft pilots have very high earnings, especially those employed by national airlines.

- Pilots usually start with smaller commuter and regional airlines to acquire the experience needed to qualify for higher paying jobs with national airlines.

- Most pilots have traditionally learned to fly in the military, but growing numbers are entering from civilian FAA certified pilot training schools.

Nature of the Work

Pilots are highly trained professionals who fly airplanes and helicopters to carry out a wide variety of tasks. Although most pilots transport passengers and cargo, others are involved in more unusual tasks, such as dusting crops, spreading seed for reforestation, testing aircraft, directing fire fighting efforts, tracking criminals, monitoring traffic, and rescuing and evacuating injured persons.

Except on small aircraft, two pilots usually make up the cockpit crew. Usually, the most experienced pilot, the *captain*, is in command and supervises all other crew members. The pilot and copilot share flying and other duties, such as communicating with air traffic controllers and monitoring the instruments. Some large aircraft have a third pilot—*the flight engineer*—who assists the other pilots by monitoring and operating many of the instruments and systems, making minor inflight repairs, and watching for other aircraft. New technology can perform many flight tasks, however, and virtually all new aircraft now fly with only two pilots, who rely more heavily on computerized controls. As older, less technologically sophisticated aircraft continue to retire from airline fleets, flight engineer jobs will diminish.

Before departure, pilots plan their flights carefully. They thoroughly check their aircraft to make sure that the engines, controls, instruments, and other systems are functioning properly. They also make sure that baggage or cargo has been loaded correctly. They confer with flight dispatchers and aviation weather forecasters to find out about weather conditions enroute and at their destination. Based on this information, they choose a route, altitude, and speed that will provide the fastest, safest, and smoothest flight. When flying under instrument flight rules—procedures governing the operation of the aircraft when there is poor visibility—the pilot in command, or the company dispatcher, normally files an instrument flight plan with air traffic control so that the flight can be coordinated with other air traffic.

Takeoff and landing are the most difficult parts of the flight and require close coordination between the pilot and first officer. For example, as the plane accelerates for takeoff, the pilot concentrates on the runway while the first officer scans the instrument panel. To calculate the speed they must attain to become airborne, pilots consider the altitude of the airport, outside temperature, weight of the plane, and the speed and direction of the wind. The moment the plane reaches takeoff speed, the first officer informs the pilot, who then pulls back on the controls to raise the nose of the plane.

Unless the weather is bad, the actual flight is relatively easy. Airplane pilots, with the assistance of autopilot and the flight management computer, steer the plane along their planned route and are monitored by the air traffic control stations they pass along the way. They regularly scan the instrument panel to check their fuel supply, the condition of their engines, and the air-conditioning, hydraulic, and other systems. Pilots may request a change in altitude or route if circumstances dictate. For example, if the ride is rougher than expected, they may ask air traffic control if pilots flying at other altitudes have reported better conditions. If so, they may request a change. This procedure also may be used to find a stronger tailwind or a weaker headwind to save fuel and increase speed.

In contrast, helicopters are used for short trips at relatively low altitude, so pilots must be constantly on the lookout for trees, bridges, power lines, transmission towers, and other dangerous obstacles. Regardless of the type of aircraft, all pilots must monitor warning devices designed to help detect sudden shifts in wind conditions that can cause crashes.

Pilots must rely completely on their instruments when visibility is poor. Using the altimeter readings, they know how high above ground they are and whether or not they can fly safely over mountains and other obstacles. Special navigation radios give pilots precise information which, with the help of special maps, tell them their exact position. Other very sophisticated equipment provides directions to a point just above the end of a runway and enables pilots to land completely "blind."

Once on the ground, pilots must complete records on their flight for their organization and the Federal Aviation Administration (FAA).

The number of nonflying duties that pilots have depends on the employment setting. Airline pilots have the services of large support staffs, and consequently, perform few nonflying duties. Pilots employed by other organizations such as charter operators or businesses have many other duties. They may load the aircraft, handle all passenger luggage to ensure a balanced load, and supervise refueling; other nonflying responsibilities include keeping records, scheduling flights, arranging for major maintenance, and performing minor aircraft maintenance and repair work.

Some pilots are instructors. They teach their students the principles of flight in ground-school classes and demonstrate how to operate aircraft in dual-controlled planes and helicopters. A few specially trained pilots are "examiners" or "check pilots." They periodically fly with other pilots or pilot's license applicants to make sure that they are proficient.

Working Conditions

By law, airline pilots cannot fly more than 100 hours a month or more than 1,000 hours a year. Most airline pilots fly an average of 75 hours a month and work an additional 75 hours a month performing nonflying duties. About one-fifth of all pilots work more than 40 hours a week. Most spend a considerable amount of time away from home because the majority of flights involve overnight layovers. When pilots are away from home, the airlines provide hotel accommodations, transportation between the hotel and airport, and an allowance for meals and other expenses. Airlines operate flights at all hours of the day and night, so work schedules often are irregular. Flight assignments are based on seniority.
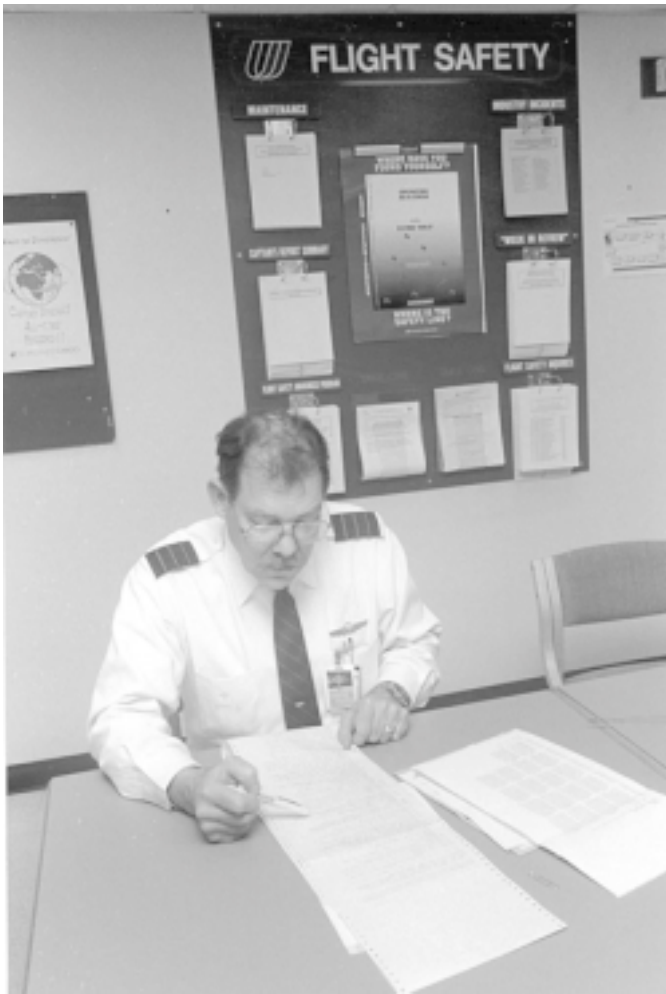
Before departure, pilots plan their flights carefully.

Those pilots not employed by the airlines often have irregular schedules as well; they may fly 30 hours one month and 90 hours the next. Because these pilots frequently have many nonflying responsibilities, they have much less free time than airline pilots. Except for business pilots, most do not remain away from home overnight. They may work odd hours. Flight instructors may have irregular and seasonal work schedules depending on their students' available time and the weather. Instructors frequently work at night or on weekends.

Airline pilots, especially those on international routes, often suffer jet lag—fatigue caused by many hours of flying through different time zones. The work of test pilots, who check the flight performance of new and experimental planes, may be dangerous. Pilots who are crop dusters may be exposed to toxic chemicals and seldom have the benefit of a regular landing strip. Helicopter pilots involved in police work may be subject to personal injury.

Although flying does not involve much physical effort, the mental stress of being responsible for a safe flight, no matter what the weather, can be tiring. Pilots must be alert and quick to react if something goes wrong, particularly during takeoff and landing.

Employment

Civilian pilots held about 94,000 jobs in 1998. About 84 percent worked for airlines. Others worked as flight instructors at local airports or for large businesses that fly company cargo and executives in their own airplanes or helicopters. Some pilots flew small planes for air taxi companies, usually to or from lightly traveled airports not served by major airlines. Others worked for a variety of businesses performing tasks such as crop dusting, inspecting pipelines, or conducting sightseeing trips. Federal, State, and local governments also employed pilots. A few pilots were self-employed.

The employment of airplane pilots is not distributed like the population. Pilots are more concentrated in California, Texas, Georgia, Washington, Nevada, Hawaii, and Alaska, which have a high amount of flying activity relative to their population.

Training, Other Qualifications, and Advancement

All pilots who are paid to transport passengers or cargo must have a commercial pilot's license with an instrument rating issued by the FAA. Helicopter pilots must hold a commercial pilot's certificate with a helicopter rating. To qualify for these licenses, applicants must be at least 18 years old and have at least 250 hours of flight experience. The time can be reduced through participation in certain flight school curricula approved by the FAA. They also must pass a strict physical examination to make sure that they are in good health and have 20/20 vision with or without glasses, good hearing, and no physical handicaps that could impair their performance. Applicants must pass a written test that includes questions on the principles of safe flight, navigation techniques, and FAA regulations. They also must demonstrate their flying ability to FAA or designated examiners.

To fly in periods of low visibility, pilots must be rated by the FAA to fly by instruments. Pilots may qualify for this rating by having 105 hours of flight experience, including 40 hours of experience in flying by instruments; they also must pass a written examination on procedures and FAA regulations covering instrument flying and demonstrate to an examiner their ability to fly by instruments.

Airline pilots must fulfill additional requirements. Pilots must have an airline transport pilot's license. Applicants for this license must be at least 23 years old and have a minimum of 1,500 hours of flying experience, including night and instrument flying, and pass FAA written and flight examinations. Usually they also have one or more advanced ratings, such as multi-engine aircraft or aircraft type ratings dependent upon the requirements of their particular flying jobs. Because pilots must be able to make quick decisions and accurate judgments under pressure, many airline companies reject applicants who do not pass required psychological and aptitude tests.

All licenses are valid as long as a pilot can pass the periodic physical examinations and tests of flying skills required by Federal Government and company regulations.

The Armed Forces have always been an important source of trained pilots for civilian jobs. Military pilots gain valuable experience on jet aircraft and helicopters, and persons with this experience are usually preferred for civilian pilot jobs. This primarily reflects the extensive flying time military pilots receive. Persons without armed forces training also become pilots by attending flight schools. The FAA has certified about 600 civilian flying schools, including some colleges and universities that offer degree credit for pilot training. Over the projection period, Federal budget reductions are expected to reduce military pilot training. As a result, FAA certified schools will train a larger share of pilots than in the past. Prospective pilots may also learn to fly by taking lessons from individual FAA-certified flight instructors.

Although some small airlines will hire high school graduates, most airlines require at least 2 years of college and prefer to hire college graduates; about 90 percent of all pilots have completed some college. In fact, most entrants to this occupation have a college degree. If the number of college educated applicants continues to increase, employers may make a college degree an educational requirement.

Depending on the type of aircraft, new airline pilots start as first officers or flight engineers. Although some airlines favor applicants who already have a flight engineer's license, they may provide flight engineer training for those who have only the commercial license. Many pilots begin with smaller regional or commuter airlines where

they obtain experience flying passengers on scheduled flights into busy airports in all weather conditions. These jobs often lead to higher paying jobs with bigger, national airlines.

Initial training for airline pilots includes a week of company indoctrination, 3 to 6 weeks of ground school and simulator training, and 25 hours of initial operating experience, including a check-ride with an FAA aviation safety inspector. Once trained and "on the line," pilots are required to attend recurrent training and simulator checks twice a year throughout their career.

Organizations other than airlines usually require less flying experience. However, a commercial pilot's license is a minimum requirement, and employers prefer applicants who have experience in the type of craft they will be flying. New employees usually start as first officers, or fly less sophisticated equipment. Test pilots often are required to have an engineering degree.

Advancement for all pilots usually is limited to other flying jobs. Many pilots start as flight instructors, building up their flying hours while they earn money teaching. As they become more experienced, these pilots occasionally fly charter planes or perhaps get jobs with small air transportation firms, such as air taxi companies. Some advance to business flying jobs. A small number get flight engineer jobs with the airlines.

In the airlines, advancement usually depends on seniority provisions of union contracts. After 1 to 5 years, flight engineers advance according to seniority to first officer and, after 5 to 15 years, to captain. Seniority also determines which pilots get the more desirable routes. In a nonairline job, a first officer may advance to pilot and, in large companies, to chief pilot or director of aviation in charge of aircraft scheduling, maintenance, and flight procedures.

Job Outlook
Pilots are expected to face considerable competition for jobs through the year 2008 because the number of applicants for new positions is expected to exceed the number of job openings. Competition will be especially keen early in the projection period due to a temporary increase in the pool of qualified pilots seeking jobs. Mergers and bankruptcies during the recent restructuring of the industry caused a large number of airline pilots to lose their jobs. Also, Federal budget reductions resulted in many pilots leaving the Armed Forces. These and other qualified pilots seek jobs in this occupation because it offers very high earnings, glamour, prestige, and free or low cost travel benefits. As time passes, some pilots will fail to maintain their qualifications and the number of applicants competing for each opening should decline. Factors affecting demand, however, are not expected to ease that competition.

Relatively few jobs will be created from rising demand for pilots as employment is expected to increase more slowly than the average for all occupations through 2008. The expected growth in airline passenger and cargo traffic will create a need for more airliners, pilots, and flight instructors. However, computerized flight management systems on new aircraft will eliminate the need for flight engineers on those planes, thus restricting the growth of pilot employment. In addition, the trend toward using larger planes in the airline industry will increase pilot productivity. Future business travel could also be adversely affected by the growing use of teleconferencing; facsimile mail; and electronic communications, such as e-mail; as well as the elimination of many middle management positions in corporate downsizing. Employment of business pilots is expected to grow slower than in the past as more businesses opt to fly with regional and smaller airlines serving their area rather than buy and operate their own aircraft. On the other hand, the number of helicopter pilots is expected to increase more rapidly as the demand expands for the type of services that helicopters can offer, such as police and rescue operations.

Job openings resulting from the need to replace pilots who retire or leave the occupation traditionally have been very low. Aircraft pilots usually have a strong attachment to their occupation because it requires a substantial investment in specialized training that is not transferable to other fields, and it commonly offers very high earnings. However, many of the pilots who were hired in the late 1960's are approaching the age for mandatory retirement, so retirements of pilots are expected to increase and generate several thousand job openings each year.

Pilots who have logged the greatest number of flying hours in the more sophisticated equipment typically have the best prospects. This is the reason military pilots usually have an advantage over other applicants. Job seekers with the most FAA licenses will also have a competitive advantage. Opportunities for pilots in the regional commuter airlines and international service are expected to be more favorable as these segments are expected to grow faster than other segments of the industry.

Employment of pilots is sensitive to cyclical swings in the economy. During recessions, when a decline in the demand for air travel forces airlines to curtail the number of flights, airlines may temporarily furlough some pilots. Commercial and corporate flying, flight instruction, and testing of new aircraft also decline during recessions, adversely affecting pilots in those areas.

Earnings
Earnings of airline pilots are among the highest in the Nation, and depend on factors such as the type, size, and maximum speed of the plane, and the number of hours and miles flown. For example, pilots who fly jet aircraft usually earn higher salaries than turbo-prop pilots do. In 1998, median annual earnings of aircraft pilots and flight engineers were $91,750. Pilots and flight engineers may earn extra pay for night and international flights.

Airline pilots usually are eligible for life and health insurance plans financed by the airlines. They also receive retirement benefits and if they fail the FAA physical examination at some point in their careers, they get disability payments. In addition, pilots receive an expense allowance, or "per diem," for every hour they are away from home. Per diem can represent up to $500 each month in addition to their salary. Some airlines also provide allowances to pilots for purchasing and cleaning their uniforms. As an additional benefit, pilots and their immediate families usually are entitled to free or reduced fare transportation on their own and other airlines.

More than one-half of all aircraft pilots are members of unions. Most of the pilots who fly for the major airlines are members of the Airline Pilots Association, International, but those employed by one major airline are members of the Allied Pilots Association. Some flight engineers are members of the Flight Engineers' International Association.

Related Occupations
Although they are not in the cockpit, air traffic controllers and flight dispatchers also play an important role in making sure flights are safe and on schedule, and participate in many of the decisions pilots must make.

Sources of Additional Information
Information about job opportunities, salaries for a particular airline and the qualifications required may be obtained by writing to the personnel manager of the airline.

For information on airline pilots, contact:
☛ Airline Pilots Association, 1625 Massachusetts Ave. NW., Washington, DC 20036.
☛ Air Transport Association of America, 1301 Pennsylvania Ave. NW., Suite 1110, Washington, DC 20006.

For information on helicopter pilots, contact:
☛ Helicopter Association International, 1619 Duke St., Alexandria, VA 22314.

For a copy of List of Certificated Pilot Schools, write to:
☛ Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. There is a $2.75 charge for this publication.

For information about job opportunities in companies other than airlines, consult the classified section of aviation trade magazines and apply to companies that operate aircraft at local airports.

Air Traffic Controllers

(O*NET 39002)

Significant Points

- Nearly all air traffic controllers are employed and trained by the Federal Government.

- Keen competition is expected in this occupation.

- Aircraft controllers earn relatively high pay and have good benefits.

Nature of the Work
The air traffic control system is a vast network of people and equipment that ensures the safe operation of commercial and private aircraft. Air traffic controllers coordinate the movement of air traffic to make certain that planes stay a safe distance apart. Their immediate concern is safety, but controllers also must direct planes efficiently to minimize delays. Some regulate airport traffic; others regulate flights between airports.

Although *airport tower* or *terminal controllers* watch over all planes traveling through the airport's airspace, their main responsibility is to organize the flow of aircraft in and out of the airport. Relying on radar and visual observation, they closely monitor each plane to ensure a safe distance between all aircraft and to guide pilots between the hangar or ramp and the end of the airport's airspace. In addition, controllers keep pilots informed about changes in weather conditions such as wind shear—a sudden change in the velocity or direction of the wind that can cause the pilot to lose control of the aircraft.

During arrival or departure, several controllers direct each plane. As a plane approaches an airport, the pilot radios ahead to inform the terminal of its presence. The controller in the radar room, just beneath the control tower, has a copy of the plane's flight plan and already has observed the plane on radar. If the path is clear, the controller directs the pilot to a runway; if the airport is busy, the plane is fitted into a traffic pattern with other aircraft waiting to land. As the plane nears the runway, the pilot is asked to contact the tower. There, another controller, who also is watching the plane on radar, monitors the aircraft the last mile or so to the runway, delaying any departures that would interfere with the plane's landing. Once the plane has landed, a ground controller in the tower directs it along the taxiways to its assigned gate. The ground controller usually works entirely by sight, but may use radar if visibility is very poor.

The procedure is reversed for departures. The ground controller directs the plane to the proper runway. The local controller then informs the pilot about conditions at the airport, such as weather, speed and direction of wind, and visibility. The local controller also issues runway clearance for the pilot to take off. Once in the air, the plane is guided out of the airport's airspace by the departure controller.

After each plane departs, airport tower controllers notify *enroute controllers* who will next take charge. There are 21 enroute control centers located around the country, each employing 300 to 700 controllers, with more than 150 on duty during peak hours at the busier facilities. Airplanes usually fly along designated routes; each center is assigned a certain airspace containing many different routes. Enroute controllers work in teams of up to three members, depending on how heavy traffic is; each team is responsible for a section of the center's airspace. A team, for example, might be responsible for all planes that are between 30 to 100 miles north of an airport and flying at an altitude between 6,000 and 18,000 feet.

To prepare for planes about to enter the team's airspace, the radar associate controller organizes flight plans coming off a printer. If two planes are scheduled to enter the team's airspace at nearly the same time, location, and altitude, this controller may arrange with the preceding control unit for one plane to change its flight path. The previous unit may have been another team at the same or an adjacent center, or a departure controller at a neighboring terminal. As a plane approaches a team's airspace, the radar controller accepts responsibility for the plane from the previous controlling unit. The controller also delegates responsibility for the plane to the next controlling unit when the plane leaves the team's airspace.

The radar controller, who is the senior team member, observes the planes in the team's airspace on radar and communicates with the pilots when necessary. Radar controllers warn pilots about nearby planes, bad weather conditions, and other potential hazards. Two planes on a collision course will be directed around each other. If a pilot wants to change altitude in search of better flying conditions, the controller will check to determine that no other planes will be along the proposed path. As the flight progresses, the team responsible for the aircraft notifies the next team in charge. Through team coordination, the plane arrives safely at its destination.

Both airport tower and enroute controllers usually control several planes at a time; often, they have to make quick decisions about completely different activities. For example, a controller might direct a plane on its landing approach and at the same time provide pilots entering the airport's airspace with information about conditions at the airport. While instructing these pilots, the controller also would observe other planes in the vicinity, such as those in a holding pattern waiting for permission to land, to ensure that they remain well separated.

In addition to airport towers and enroute centers, air traffic controllers also work in flight service stations operated at over 100 locations. These *flight service specialists* provide pilots with information on the station's particular area, including terrain, preflight and inflight weather information, suggested routes, and other information important to the safety of a flight. Flight service station specialists help pilots in emergency situations and initiate and coordinate searches for missing or overdue aircraft. However, they are not involved in actively managing air traffic.

Some air traffic controllers work at the Federal Aviation Administration's (FAA) Air Traffic Control Systems Command Center in Herndon, Virginia, where they oversee the entire system. They look for situations that will create bottlenecks or other problems in the system, then respond with a management plan for traffic into and out of the troubled sector. The objective is to keep traffic levels in the trouble spots manageable for the controllers working at enroute centers.

Currently, the FAA is in the midst of developing and implementing a new automated air traffic control system. As a result, more powerful computers will help controllers deal with the demands of increased air traffic. Some traditional air traffic controller tasks—like determining how far apart planes should be kept—will be done by computer. Present separation standards call for a 2,000-foot vertical spacing between two aircraft operating above 29,000 feet and flying the same ground track. With the aid of new technologies, the FAA will be able to reduce this vertical separation standard to 1,000 feet. Improved communication between computers on airplanes and those on the ground also is making the controller's job a little easier.

At present controllers sit at consoles with green-glowing screens that display radar images generated by a computer. In the future, controllers will work at a modern workstation computer that depicts air routes in full-color on a 20- by 20-inch screen. The controllers will select radio channels simply by touching on-screen